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CERTIFICATE

I, Tadashi UEDA, residing at 1994-152, Hazama-machi, Hachioji-shi, Tokyo, 193-0941 Japan, hereby certify that I am the translator of the attached document, namely a Certified Copy of Japanese Patent Application No. 2002-201662 and certify that the following is a true translation to the best of my knowledge and belief.

Tadashi Ueda — August 9, 2005

Signature of Translator — Date

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[Name of Document]	Abstract 1
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[Name of Document] SPECIFICATION

[Title of the Invention] THIN-FILM-TRANSISTOR DRIVING AND LIGHT-EMITTING DISPLAY DEVICE

[Claims]

[Claim 1] A thin-film-transistor driving and light-emitting display device comprising: a plurality of scanning lines and a plurality of signal lines being provided in a matrix; and

a switching thin-film transistor, a driving thin-film transistor, and a light-emitting element being provided at each intersection of the scanning lines and the signal lines,

wherein the switching thin-film transistor samples the potential of the corresponding signal line when the corresponding scanning line has an ON potential,

the driving thin-film transistor controls the light-emitting state of the light-emitting element in accordance with the sampled potential, and

in the driving thin-film transistor, a lightly doped region is provided only in a drain region.

[Claim 2] A thin-film-transistor driving and light-emitting display device comprising: a plurality of scanning lines and a plurality of signal lines being provided in a matrix, and

a switching thin-film transistor, a driving thin-film transistor, and a light-emitting element being provided at

each intersection of the scanning lines and the signal lines,

wherein the switching thin-film transistor samples the potential of the corresponding signal line when the corresponding scanning line has an ON potential,

the driving thin-film transistor controls the light-emitting state of the light-emitting element in accordance with the sampled potential,

lightly doped regions are provided both in a source region and a drain region, and

the length of the lightly doped region in the drain region is longer than the length of the lightly doped region in the source region.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a display device which drives light-emitting elements with a thin-film transistor.

[0002]

[Description of the Related Art]

Recently, research, development, and commercialization of thin-film-transistor driving and light-emitting-diode display devices, which are one type of thin-film-transistor driving and light-emitting display devices, have been actively conducted (T. Shimoda, M. Kimura, et al., Proc. Asia Display '98, 217; M. Kimura, et al., IEEE Trans. Electron. Devices 46 (1999), 2282; T. Shimoda, M. Kimura, et al., Dig. SID '99, 372; M. Kimura et al., Proc. Euro Display '99 Late-News Papers, 71; M. Kimura, et al., Proc. IDW '99 171; S.W.-B. Tam, M. Kimura, et al., Proc. IDW '99, 175; M. Kimura, et al., J. SID 8, 93 (2000); M. Kimura, et al., Dig. AM-LCD 2000, 245; and S.W.-B Tam, M. Kimura, et al., Proc. IDW 2000, 243).

[0003]

Fig. 1 is an equivalent circuit diagram of a pixel in a thin-film-transistor driving and light-emitting display device. A plurality of scanning lines 11 and a plurality of signal lines 12 are arranged in a matrix. At each of the

intersections of the scanning lines 11 and the signal lines 12, a switching thin-film transistor 13, a driving thin-film transistor 14, and a light-emitting element 15 are provided. The switching thin-film transistor 13 samples the potential of the corresponding signal line 12 when the corresponding scanning line 11 has an ON potential. The driving thin-film transistor 14 controls the light-emitting state of the light-emitting element 15 on the basis of the sampled potential.

[0004]

Fig. 2 is a structural drawing of a driving thin-film transistor and a light-emitting element in the known thin-film-transistor driving and light-emitting display device. In a driving thin-film transistor 21, an active region 23 and heavily doped regions 26 are directly connected to each other in both a source region 24 and a drain region 25 (self-aligned structure). With the self-aligned structure, the driving thin-film transistor 21 allows a large current to flow through a light-emitting element 22, thus achieving a high-intensity thin-film-transistor driving and light-emitting display device.

[0005]

[Problems to be Solved by the Invention]

Since the driving thin-film transistor 21 has the self-aligned structure, a large current is allowed to flow

through the light-emitting element 22. The self-aligned structure is known to have a tendency to deteriorate over time (S. Inoue, et al., Dig. SID '99, 452 and Y. Uraoka, et al., Dig. AM-LCD '01, 179). Furthermore, since the driving thin-film transistor 21 allows a direct current to flow at all times, the driving thin-film transistor 21 tends to deteriorate over time.

Accordingly, it is an object of the present invention to prevent the performance of a driving thin-film transistor 21 of a thin-film-transistor driving and light-emitting display device from deteriorating over time while maintaining a function of allowing a relatively large current to flow.

[0006]

[Means for Solving the Problems]

The present invention as set forth in claim 1 is a thin-film-transistor driving and light-emitting display device including a plurality of scanning lines and a plurality of signal lines being provided in a matrix, and a switching thin-film transistor, a driving thin-film transistor, and a light-emitting element being provided at each intersection of the scanning lines and the signal lines. The switching thin-film transistor samples the potential of the corresponding signal line when the corresponding scanning line has an ON potential. The driving thin-film

transistor controls the light-emitting state of the light-emitting element in accordance with the sampled potential. In the driving thin-film transistor, a lightly doped region is provided only in a drain region (one-sided LDD structure).

[0007]

The present invention as set forth in claim 16 is a thin-film-transistor driving and light-emitting display device comprising a plurality of scanning lines and a plurality of signal lines being provided in a matrix, and a switching thin-film transistor, a driving thin-film transistor, and a light-emitting element being provided at each intersection of the scanning lines and the signal lines. The switching thin-film transistor samples the potential of the corresponding signal line when the corresponding scanning line has an ON potential. The driving thin-film transistor controls the light-emitting state of the light-emitting element in accordance with the sampled potential. Lightly doped regions are provided both in a source region and a drain region. The length of the lightly doped region in the drain region is longer than the length of the lightly doped region in the source region (asymmetrical LDD structure).

[0008]

In general, the LDD structure prevents deterioration over time (Takayuki Ohno, Yukiharu Uraoka, et al.,

Shingakugihou (Technical Report of IEICE) ED2000-7, 43(2000)). Since the present invention employs the one-sided LDD structure or the asymmetrical LDD structure, the driving thin-film transistor of the thin-film-transistor driving and light-emitting display device maintains the function of allowing a large current to flow while being prevented from deteriorating over time. In addition, since the current direction of the light-emitting element is determined, the source region side and the drain region side of the driving thin-film transistor are determined. Therefore, there will be no confusion as to the providing of the one-sided LDD structure or the asymmetrical LDD structure.

[0009]

Also, compared with a both-sided LDD structure, the present invention can allow a large current to flow even when the driving thin-film transistor applies a low voltage. The voltage applied to the scanning lines and the signal lines can be reduced, and hence the power consumption of a built-in drive circuit and an external drive circuit can be reduced. Furthermore, narrowing of the driving thin-film transistor is made possible, leading to improvement of the light-emitting region ratio (the ratio of the light-emitting region to the entire pixel area), reduction of the current density of the light-emitting element, and elongation of

life of the light-emitting element.

[0010]

[Description of the Embodiments]

With reference to the drawings, preferred embodiments of the present invention will be described below.

[0011]

Fig. 3 is a structural drawing of a driving thin-film transistor and a light-emitting element according to a first embodiment of the present invention. As claimed in claim 1, in a driving thin-film transistor 21, a lightly doped region 27 is provided only in a drain region 25, resulting in a one-sided LDD structure.

[0012]

Fig. 4 is a structural drawing of a driving thin-film transistor and a light-emitting element according to a second embodiment of the present invention. As claimed in claim 2, in the driving thin-film transistor 21, the lightly doped regions 27 are provided both in the source region 24 and the drain region 25. The lightly doped region 27 in the drain region 25 is longer than the lightly doped region 27 in the source region 24, resulting in an asymmetrical LDD structure.

[0013]

Incidentally, in the first and second embodiments, the conductive type of the driving thin-film transistor 21 is p-

type, and a current flows through the light-emitting element 22 in the direction from the driving thin-film transistor 21 to the light-emitting element 22. Therefore, the drain region 25 is provided at a location connected to the light-emitting element 22. In contrast, if the conductive type of the driving thin-film transistor 21 is n-type or if a current flows through the light-emitting element 22 in the direction from the light-emitting element 22 to the driving thin-film transistor 21, the drain region 25 is provided at a location that is not connected to the light-emitting element 22. Accordingly, the one-sided LDD structure or the asymmetrical LDD structure must be provided.

[Brief Description of the Drawings]

[Fig. 1]

Fig. 1 is an equivalent circuit diagram of a pixel in a thin-film-transistor driving and light-emitting display device.

[Fig. 2]

Fig. 2 is a structural drawing of a driving thin-film transistor and a light-emitting element in the known thin-film-transistor driving and light-emitting display device.

[Fig. 3]

Fig. 3 is a structural drawing of a driving thin-film transistor and a light-emitting element according to a first embodiment of the present invention.

[Fig. 4]

Fig. 4 is a structural drawing of a driving thin-film transistor and a light-emitting element according to a second embodiment of the present invention.

[Reference Numerals]

11 scanning lines

12 signal lines

13 switching thin-film transistors

14 driving thin-film transistor

15 light-emitting element

21 driving thin-film transistors

22 light-emitting elements

23 active regions

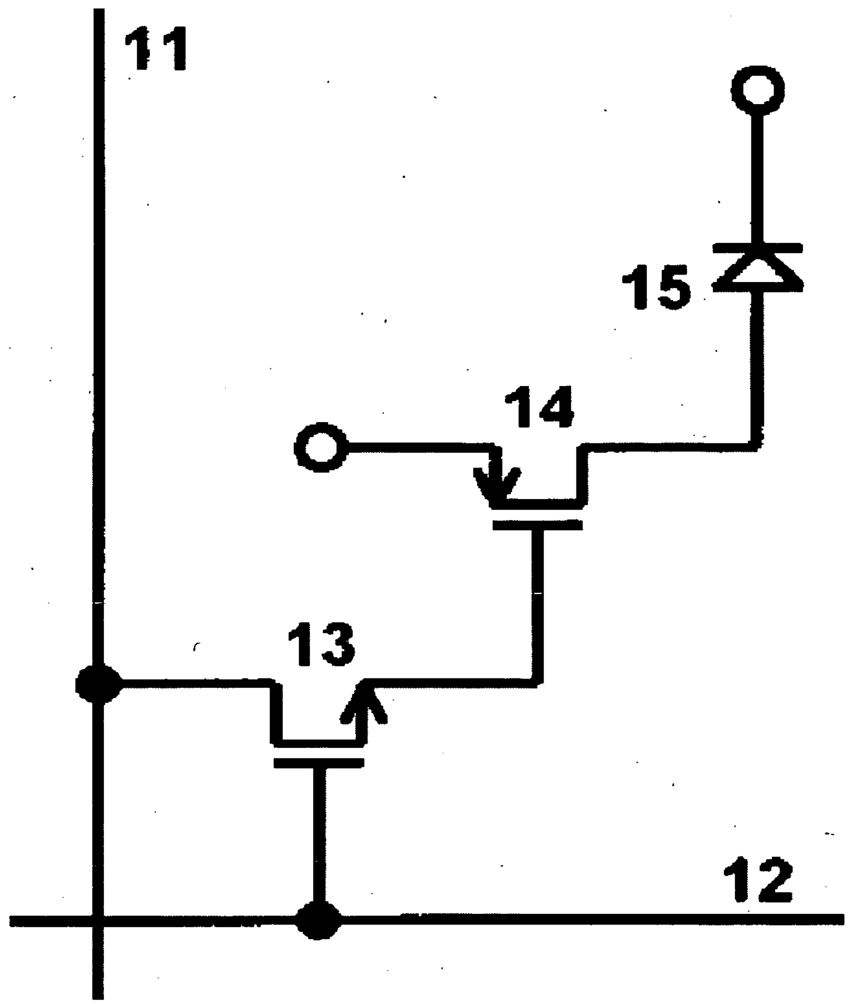
24 source regions

25 drain regions

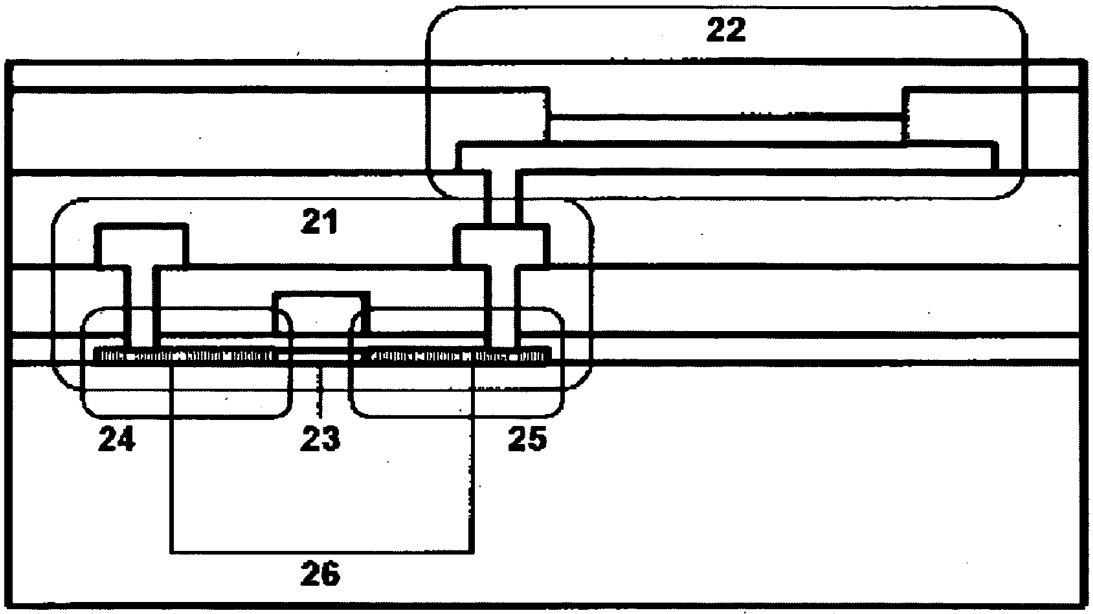
26 heavily doped regions

27 lightly doped regions

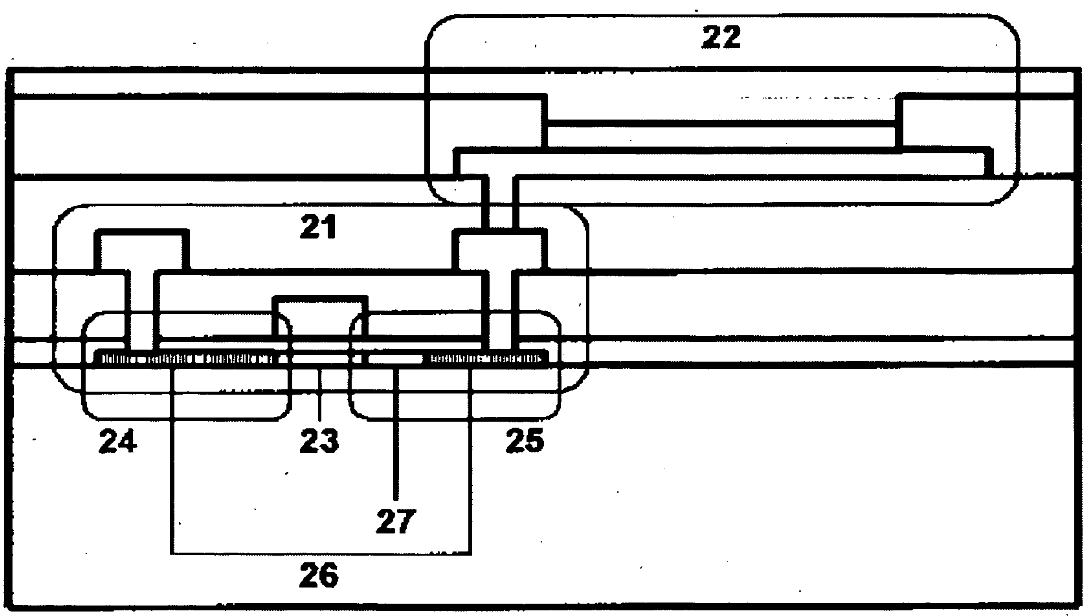
[FIG. 1]



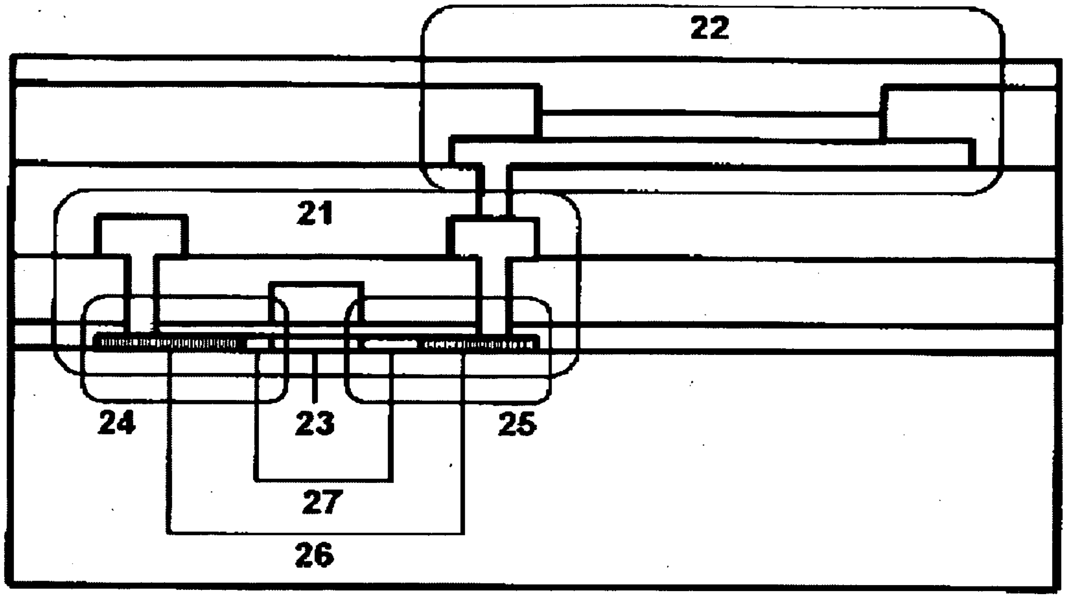
[FIG. 2]



[FIG. 3]



[FIG. 4]



[Name of Document] ABSTRACT

[Abstract]

[Object] An object of the present invention is to prevent the performance of a driving thin-film transistor 21 of a thin-film-transistor driving and light-emitting display device from deteriorating over time while maintaining a function of allowing a relatively large current to flow.

[Solving Means] In a driving thin-film transistor 21, a lightly doped region 27 is provided only in a drain region 25 (one-sided LDD structure). Alternatively, lightly doped regions 27 are provided in both a source region 24 and the drain region 25, and the lightly doped region 27 in the drain region 25 is longer than the lightly doped region 27 in the source region 24 (an asymmetrical LDD structure).

[Selected Figure] Fig. 3